Amendments to the Drawings:

The attached sheet of drawings on which Figs. 6 and 7 appear includes changes to Fig. 7. This sheet replaces the original sheet including Figs. 6 and 7. The amendments to Fig. 7 include changing reference numeral "48" to --49-- to eliminate duplicate component numbering and deleting a "prior art" designation from the "Fig. 7" caption.

A complete set of five sheets of formal drawings replacing all original drawings is attached.

Attachments: five sheets of replacement, formal drawings

Remarks

Claims 1-14, 17, and 21-39 are in the application, of which claims 1, 21, 31, and 37 are independent. Claims 15, 16, and 18-20 are canceled, and claims 21-39 are new. Claims 2, 15, 16, and 18-20 recite allowable subject matter, and the subject matter of claims 15, 16, and 18-20 is recited in new claims 31, 34, and 37-39. The appendix to this paper presents a set of formal drawings replacing all original drawings and including the above-noted changes to Fig. 7.

Applicants have amended paragraphs [0003], [0009], [0016], and [0028] of the application to more accurately describe the fabrication of electronic circuit components composed of ceramic substrates. For example, a resistor is formed by printing resistive material on a surface of a ceramic substrate (see application paragraph [0010]) and a capacitor is formed in the interior of a ceramic substrate (see application paragraph [0028] with reference to screen printing for multi-layer chip capacitors). Skilled persons know that capacitors are formed in an array by printing electrically conductive ink strips at predetermined locations on multiple layers of ceramic material and stacking them so that the locations of the ink strips associated with each capacitor are spatially aligned.

Applicants have also amended paragraph [0038] to make more precise a description of the circuit component side margins, paragraph [0050] to make it consistent with Table VIII, and paragraph [0055] to remove an erroneous prior art designation and correct an occurrence of a duplicate reference numeral.

Except for claims 2, 15, 16, and 18-20, all pending claims stand rejected for anticipation by Liu et al., Brown et al., or both of them. Applicants offer the following opening comments before specifically addressing these rejections.

Liu et al. and Brown et al. each describe use of laser cuts to form scribe lines that separate active electronic components (blue laser diodes) formed on a common sapphire substrate. Liu et al. apparently uses a UV laser beam characterized by a Gaussian beam profile, but Brown et al. uses a mask to shape a UV excimer (KrF) or an infrared (1064 nm) laser beam.

Despite the similarity of their blue laser diode (active electronic component)-carrying sapphire substrate targets, Liu et al. and Brown et al. contradict each other in that the former requires a depth of cut of at least 50% of the sapphire substrate thickness but the latter describes a depth of cut of between about 7.7% and 23.1% of the sapphire substrate thickness.

To support her anticipation rejections, the Examiner equates a sapphire substrate and a ceramic substrate. (As the Examiner noted, Brown et al. makes a passing reference to refractory ceramics as possible substrate material.) Acknowledging that sapphire represents single crystal alumina and ceramic represents sintered alumina, applicants contend that the methods of preparation and resulting macrostructures of sapphire and ceramic are very different and are not regarded by skilled persons as equivalent.

Specifically, significant differences between single crystal alumina (Al_2O_3) (sapphire) and sintered alumina (ceramic) pertain to their methods of preparation and resulting macrostructures. Single crystal alumina is formed by melting and slow cooling of bulk material, while ceramics are formed by sintering powders and binders at high pressures but low temperatures (well below melting point). The net result is that sapphire is chemically and optically pure (homogeneously and known doping, transparent over a wide spectrum). In contrast, ceramics tend to be translucent at best and heavily grained with large impurity concentrations along grain boundaries.

Other practical aspects arise from the macrostructures. Sapphire has distinct crystal planes along which cleavages are strongly directed or oriented ("cleavage planes"). Ceramics do not have a cleavage plane and, therefore, crack along the grain boundaries in an irregular fashion. Sapphire, like single crystal silicon, will cleave in a very straight line from a single stress point, while ceramics will generally cleave in random orientations and directions unless given full directional assistance, which is provided by a scribe line.

The specification provides support for the distinction between sapphire and ceramic materials presented above. Paragraphs [0007], [0010] – [0012], [0043], and [0055] refer to fired ceramic substrates, thereby describing sintered alumina (ceramic). Paragraph [0028] refers to multi-layer chip capacitors (MLCCs), and paragraph [0055] refers to multi-layer ceramic components such as MLCCs, stacked green layers, and firing of a resulting ceramic structure. These statements mentioning multi-layer ceramic component structures refer not to single crystal alumina (sapphire) but to sintered alumina (ceramic). Moreover, paragraphs [0016] and [0034] refer to ceramic substrates carrying multiple electronic components including capacitors and resistors (paragraph [0016]) and resistors (paragraph [0074]). Skilled persons know that, because it would be cost prohibitive, capacitors and resistors are formed not with sapphire substrates but with ceramic substrates. Applicants contend, therefore, that a sapphire substrate differs materially from a ceramic substrate in the formation of an electronic component.

Claims 1, 3, 4, 7-10, 12-14, and 17 stand rejected under 35 USC § 102(e) for anticipation by Liu et al. Applicants dispute this rejection and request that it be withdrawn because Liu et al. describes a sapphire substrate, which is not contemplated by the pending claims.

Claims 1, 5-8, 10, 11, and 14 stand rejected under 35 USC § 102(e) by Brown et al. Noting the indication of allowability of claim 2, which specifies resistors and capacitors as electronic circuit components, applicants respond by amending claim 1 to recite a method of forming a scribe line in a ceramic substrate on or in the interior of which is formed a pattern of passive electronic components. Applicants contend that amended claim 1, together with its dependent claims, is patentable because Liu et al. and Brown et al. each describe laser cutting of a substrate on which active electronic components are formed. Moreover, the contradictory teachings of Liu et al. and Brown et al. as to the required depth of cut into the same target material makes suspect their teachings for active electronic components, much less for any attempt to extend their teachings to passive electronic components, which include resistors and capacitors.

New independent claim 21 recites a method of forming a scribe line in a ceramic substrate with the use of a UV laser beam characterized in part by primarily a TEM_{00} spatial mode profile to cut a trench to a depth that is between about 5% and 25% of the ceramic substrate thickness. Support for a primarily TEM_{00} spatial mode profile can be found in the specification at paragraph [0029] and paragraphs [0042]-[0044] and [0049] referring to a Gaussian beam. The degree of departure from a Gaussian beam profile (*i.e.*, TEM_{00} spatial mode) is constrained by the specification of a trench having a trench bottom in the form of a sharp snap line. Support for the 5%-25% range of depth of cut can be found in the specification at paragraph [0037]. None of the prior art of record renders claim 21 unpatentable. With specific reference to the two patents on which the Examiner relied, Liu et al. uses a laser to cut a trench that is at least 50% of the thickness of a nonceramic (sapphire) substrate, and Brown et al. uses a mask to shape the excimer or infrared laser beam profile. Applicants request, therefore, that claim 21 and its dependent claims 22-30 be allowed.

New claim 31 recites in independent form the allowable subject matter of canceled claim 15, and claim 34 recites the allowable subject matter of canceled claim 16. Support for claim 32 can be found in the specification at paragraph [0056] and for claims 33, 35, and 36 at paragraph [0055].

New claim 37 recites in independent form the allowable subject matter of canceled claim 18, and claims 38 and 39 recite the allowable subject matter of canceled claims 19 and 20, respectively.

Applicants believe their application is in condition for allowance and respectfully request the same.

Respectfully submitted,

Edward J. Swenson, Yunlong Sun, Manoj Kumar Sammi, and Jay Christopher Johnson

By _____
Paul S. Angello
Registration No. 30,991

STOEL RIVES LLP
900 SW Fifth Avenue, Suite 2600
Portland, OR 97204-1268
Telephone: (503) 224-3380
Facsimile: (503) 220-2480
Attorney Docket No. 50001/97:1